MCKENNA-JOJO AIR LEASE
Allegheny National Forest
Oil Heritage ~~Recording Project~~
Kane Field
Kane Vicinity
McKean County
Pennsylvania

HAER No. PA-442

HAER
PA
42-KAN.V,
1-

PHOTOGRAPHS

XEROGRAPHIC COPIES OF COLOR TRANSPARENCIES

Historic American Engineering Record
National Park Service
Department of the Interior
1849 C Street, NW
Washington, DC 20240

ADDENDUM TO:
MCKENNA-JOJO AIR LEASE
Kane Field
Kane vicinity
McKean County
Pennsylvania

HAER PA-442
PA,42-KAN.V,1-

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

ADDENDUM TO
MCKENNA-JOJO AIR LEASE

HAER No. PA-442

LOCATION: Kane Field, Kane Vicinity, McKean County, Pennsylvania
UTM: 17.677660.4611030

DATE OF CONSTRUCTION: ca. 1920

PRESENT OWNER: Charles McKenna

PRESENT USE: Active pumping installation

SIGNIFICANCE: Pennsylvania is the birthplace of the petroleum industry, signified by the drilling of Edwin Drake's well near Titusville in 1859. Many widely used techniques of drilling and pumping oil were first developed here in the effort to recover the high-quality "Pennsylvania Grade" oil. One particularly important, and successful, technique perfected in Pennsylvania was "central power" pumping of numerous low-production wells to economically recover small amounts of oil. This method of production flourished between ca. 1890 and ca. 1950, and today there are only scattered remains of the once common pumping technique. The McKenna-Jojo Air Lease is a rare example of "air lease" or "air power", a somewhat anomalous power-type developed in the Bradford, Pennsylvania area during the late period of central power development.

HISTORIAN: Michael W. Caplinger, 1997

PROJECT INFORMATION: The Allegheny National Forest Oil Heritage Recording Project was undertaken during the summer of 1997 by the Historic American Engineering Record (HAER, Eric DeLony, Chief), a long-range program to document historically significant engineering, industrial and maritime works in the United States. The program is part of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Division of the National Park Service, U.S. Department of the Interior. This project was sponsored by cooperative agreements between HABS/HAER, E. Blaine Cliver, Chief; the West Virginia University Institute for the

History of Technology and Industrial Archaeology (IHTIA), Dr. Emory Kemp, Director; and Allegheny National Forest (ANF), a unit of the Eastern Region of the U.S. Department of Agriculture (USDA) Forest Service, John Palmer, Supervisor. The Southwestern Pennsylvania Heritage Preservation Commission, Randy Cooley, Director, provided major funding.

The field work, measured drawings, historical reports and photographs were prepared under the general direction of Christopher Marston, HAER Project Leader, with consultation from Phil Ross, ANF Historian. The field team was led by Eric Elmer, HAER Field Architect Supervisor and Michael Caplinger, IHTIA Historian. The team included Arturs Lapins, US/ICOMOS Intern (Latvia); and IHITA delineators Paul Boxley, Scott Daley, Kara Hurst, and Kevin McClung. John T. Nicely produced the large format photography.

See also HAER No. PA-436, “Allegheny National Forest Oil Heritage,” for a broad overview of the history of oil production in Pennsylvania and the history and operation of central power well-pumping systems.

INTRODUCTION

While petroleum would sometimes flow from a well under its own pressure, this was not usually the case. Most successful oil wells in Appalachia had a pattern of high initial production (sometimes hundreds of barrels per day per well) followed by a rapid drop off to a few barrels per day—or week—or nothing at all. Thereafter, the well had to be mechanically pumped to recover any oil. By the 1870s, the "standard" pumping outfit was in use in Pennsylvania. Much of the surface equipment used to drill a well (the engine, bandwheel, and walking beam) could be used to pump it. This was a one-engine-one-well system in which a steam-powered engine pumped a single well, termed "pumping the beam."

After a well aged and production leveled off, it required pumping for only a short period, perhaps once or a few times a week.[1] In the decade following the establishment of Drake's well, there was little impetus for pumping low-production wells after their initial outflow since new fields were continually being discovered and drillers could simply move on to sink another well. There were exceptions, however, such as when the oil tapped by a well was of extremely high quality. With oil prices extremely low, though, it cost too much to outfit, maintain and equip an installation at each well. As prices began to stabilize in the 1880s, pumping became more feasible, and economization of the process became the key to profitability. This drive for efficiency resulted in the popularization of centrally powered multiple-well pumping systems, which were perfected in Pennsylvania's oil fields.

The essential components of a central power system were: the prime mover, or engine; a power reduction/motion-conversion/power distribution unit (always called the "power" in oil-field parlance, not to be confused with the engine or prime mover), which converted the engine's rotary motion to horizontal reciprocating motion; the shackle lines (also called pull, jerker, or rod lines), which transmitted the reciprocating motion from the power out to the pump jacks; the pump jacks, which converted the horizontal reciprocating motion of the rod lines to vertical reciprocating motion; and finally, the sucker rods, which operated valves at the bottom of the well that pumped the oil to the surface. The engine and power required a substantial concrete foundation to resist the immense strains put on the machinery, and both were enclosed in a protective powerhouse. Powerhouses not only lessened the chance for fires, but also held spare parts and tools, and gave the pumper and machinery protection from the elements. These equipment configurations were generally called central powers, but the term "jack plant' was also common. With the advent of gas and oil powered engines in the mid-1890s, costs were further lowered since the engine was powered by gas produced from the very wells it was pumping—a sort of low-cost perpetual pumping machine that required little manpower or maintenance to keep in operation. By about 1900, numerous oil-well supply companies had developed standardized systems that could be purchased in part or whole.

---

[1] To increase production, a well could be "shot" or "torpedoed" with nitroglycerin to extensively fracture the oil sands at the bottom of the hole.

Certain factors controlled the use of central powers. Wells had to be relatively shallow, less than 3,000'. While up to forty shallow wells could theoretically be pumped by a well-balanced high-powered system, fifteen to twenty was a more common number. The wells had to be in relatively close proximity, within a mile. Although the shackle lines could be routed over and around difficult terrain, extreme topography could hinder their use and was sometimes better suited to individual wells pumping "on the beam." While central power systems flourished between ca. 1880 and ca. 1950, the "unit pumper," a self-contained pumping machine powered by a small gasoline engine or electric motor, succeeded them.

"Air powers" or "air leases" were a rather anomalous development found particularly in the Bradford area of Pennsylvania. They appeared around 1920 but never gained wide use. With this system, a gas engine powered an air compressor instead of the usual geared or bandwheel power; steel pipes or air hoses replaced the shackle lines. At the well heads, old steam engines were converted to pump jacks. The compressed air was simply injected into the steam cylinder, which powered a simple pitman/walking beam arrangement. These were "Barcroft rigs" in Pennsylvania. There were also "air-head" pump jacks, which were a compressed air-actuated piston/cylinder supported above the well and connected to the sucker rods, lifting them upon injection of air into the cylinder. The air-powered systems' main advantage seems to be that they had fewer moving parts than a standard shackle line system and required less maintenance.

GEOLOGY

The McKenna-Jojo Air Lease produces from the Kane field in the Kane sand. It was discovered in 1880 on lot 3788, to the northwest of lot 3767. The Kane sand is found at a depth of 2,200' to 2,500' below the surface and produces a large amount of gas with the oil. Some wells flowed nearly 300 BOPD before settled production. There were probably standard steam-powered pumping rigs on this site, pumping wells on the beam between ca. 1880 and ca. 1920 when this power was constructed. This operation is active as of the writing of this report, although it pumps from only two wells. These produce only small amounts, probably less than a barrel a day.

MACHINERY AND THE POWERHOUSE

The combination engine/compressor is a Cooper-Bessemer Company 80 horsepower unit (with electric ignition) running at about 180 r.p.m., mated with a two-stage compressor, which created a maximum force of about 50 pounds per square inch. The engine has a 14" diameter cylinder, with a piston stroke of 20".[2] It is mounted into the concrete floor of the powerhouse. A steel coolant water reservoir stands in the southwest corner of the room and holds water circulated through the engine's cylinder jacket by the thermal siphon system. A 1"-diameter pipe standing vertically out of the ground outside the

[2] This information is contained on the small builder's plate.

building drew air in before taking it underground into the powerhouse where the pipe pierces the floor and connects with the compressor end of the engine. Compressed air exits the building through 2” pipes and proceeds to a nearby air flood tank, or manifold, which cools the compressed air and distributes it to the “Barcroft rig” pump jacks through similar 2” pipes.

Compared to standard central-power powerhouses, the McKenna-Jojo powerhouse is simpler in design. The powerhouse is a one-room, wood-frame structure, rectangular in plan, with a poured concrete floor and clad in corrugated metal sheets. There is a double-door entry at either end. Both gable ends have small windows, while three large windows pierce each side of the building, so natural light is abundant. Horizontal boards cover the interior walls, while the top 1/3 of these walls and the entire ceiling is covered with tin sheeting. There is electric lighting in the building, which is a modern addition. A nearly identical storage building is located to the southeast of the power building. Local contractors specializing in pumping plant construction obtained construction materials locally and built the powerhouse. The machinery was put in place first, and then the building was erected around it.

One man, who started the engine and pumped the wells two or three times a week, maintained and operated this pumping plant. A single pumping cycle usually lasted less than two hours.

BIBLIOGRAPHY

Arnold, Ralph and William Kemnitzer. *Petroleum in the United States and Possessions*. New York: Harper Brothers Publishers, 1931.

Bacon, Raymond Foss and William Hamor. *The American Petroleum Industry*. Volume I. New York: The McGraw-Hill Book Company, 1916.

George, H.C. *Surface Machinery and Methods for Oil Well Pumping*. Department of the Interior Bureau of Mines Bulletin 224. Washington, DC: Government Printing Office, 925.